

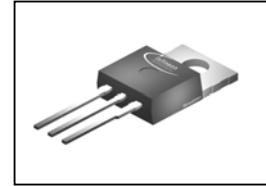
CoolMOS™ Power Transistor
Features

- Lowest figure of merit $R_{ON} \times Q_g$
- Ultra low gate charge
- Extreme dv/dt rated
- High peak current capability
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹⁾ for target applications

Product Summary

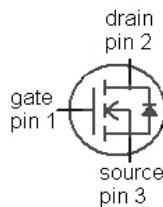
$V_{DS} @ T_{jmax}$	550	V
$R_{DS(on),max}$	0.520	Ω
$Q_{g,typ}$	13	nC

PG-T0220


CoolMOS CP is designed for:

- Hard- & Softswitching SMPS topologies
- DCM PFC for Lamp Ballast
- PWM for Lamp Ballast, PDP and LCD TV

Type	Package	Marking
IPP50R520CP	PG-T0220	5R520P


Maximum ratings, at $T_j=25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_C=25^\circ\text{C}$	7.1	A
		$T_C=100^\circ\text{C}$	4.5	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_C=25^\circ\text{C}$	15	
Avalanche energy, single pulse	E_{AS}	$I_D=2.5\text{ A}, V_{DD}=50\text{ V}$	166	mJ
Avalanche energy, repetitive t_{AR} ^{2),3)}	E_{AR}	$I_D=2.5\text{ A}, V_{DD}=50\text{ V}$	0.25	
Avalanche current, repetitive t_{AR} ^{2),3)}	I_{AR}		2.5	A
MOSFET dv/dt ruggedness	dv/dt	$V_{DS}=0\ldots400\text{ V}$	50	V/ns
Gate source voltage	V_{GS}	static	± 20	V
		AC ($f>1\text{ Hz}$)	± 30	
Power dissipation	P_{tot}	$T_C=25^\circ\text{C}$	66	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C
Mounting torque		M3 and M3.5 screws	60	Ncm

Maximum ratings, at $T_j=25\text{ }^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value		Unit
Continuous diode forward current	I_S	$T_C=25\text{ }^\circ\text{C}$	3.8	-	A
Diode pulse current ²⁾	$I_{S,pulse}$		15	-	
Reverse diode dv/dt ⁴⁾	dv/dt			15	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	R_{thJC}		-	-	1.9	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	1.6 mm (0.063 in.) from case for 10 s	-	-	260	$^\circ\text{C}$

Electrical characteristics, at $T_j=25\text{ }^\circ\text{C}$, unless otherwise specified

Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}$, $I_D=250\text{ }\mu\text{A}$	500	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$, $I_D=0.25\text{ mA}$	2.5	3	3.5	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=500\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ }^\circ\text{C}$	-	-	1	μA
		$V_{DS}=500\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=150\text{ }^\circ\text{C}$	-	10	-	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}$, $I_D=3.8\text{ A}$, $T_j=25\text{ }^\circ\text{C}$	-	0.47	0.52	Ω
		$V_{GS}=10\text{ V}$, $I_D=3.8\text{ A}$, $T_j=150\text{ }^\circ\text{C}$	-	1.2	-	
Gate resistance	R_G	$f=1\text{ MHz}$, open drain	-	2.2	-	Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Input capacitance	C_{iss}	$V_{GS}=0 \text{ V}, V_{DS}=100 \text{ V}, f=1 \text{ MHz}$	-	680	-	pF
Output capacitance	C_{oss}		-	31	-	
Effective output capacitance, energy related ⁵⁾	$C_{o(er)}$	$V_{GS}=0 \text{ V}, V_{DS}=0 \text{ V}$ to 400 V	-	29	-	
Effective output capacitance, time related ⁶⁾	$C_{o(tr)}$		-	63	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=400 \text{ V}, V_{GS}=10 \text{ V}, I_D=3.8 \text{ A}, R_G=48.3 \Omega$	-	35	-	ns
Rise time	t_r		-	14	-	
Turn-off delay time	$t_{d(off)}$		-	80	-	
Fall time	t_f		-	17	-	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	$V_{DD}=400 \text{ V}, I_D=3.8 \text{ A}, V_{GS}=0 \text{ to } 10 \text{ V}$	-	3	-	nC
Gate to drain charge	Q_{gd}		-	5	-	
Gate charge total	Q_g		-	13	17	
Gate plateau voltage	$V_{plateau}$		-	5.2	-	

Reverse Diode

Diode forward voltage	V_{SD}	$V_{GS}=0 \text{ V}, I_F=3.8 \text{ A}, T_j=25^\circ\text{C}$	-	0.9	1.2	V
Reverse recovery time	t_{rr}		-	240	-	
Reverse recovery charge	Q_{rr}		-	1.6	-	
Peak reverse recovery current	I_{rm}		-	13	-	

¹⁾ J-STD20 and JESD22

²⁾ Pulse width t_p limited by $T_{j,max}$
³⁾ Repetitive avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR} \cdot f$.

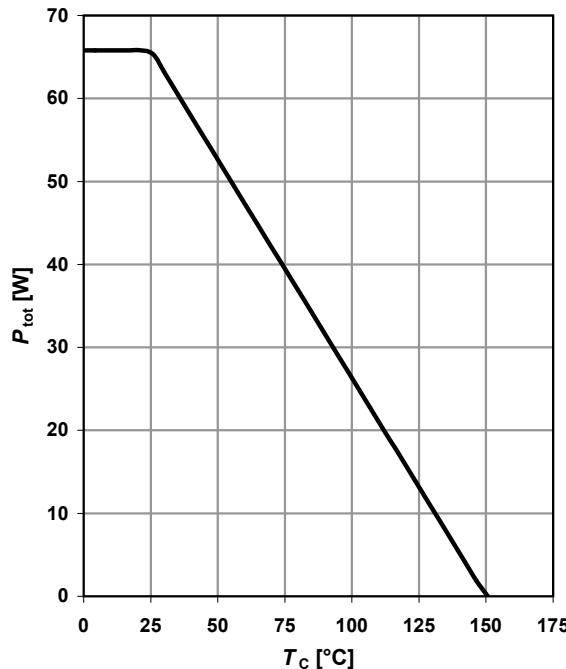
⁴⁾ $I_{SD} \leq I_D$, $di/dt \leq 400 \text{ A}/\mu\text{s}$, $V_{DClink}=400 \text{ V}$, $V_{peak} < V_{(BR)DSS}$, $T_j < T_{j,max}$, identical low and high side switch

⁵⁾ $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

⁶⁾ $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

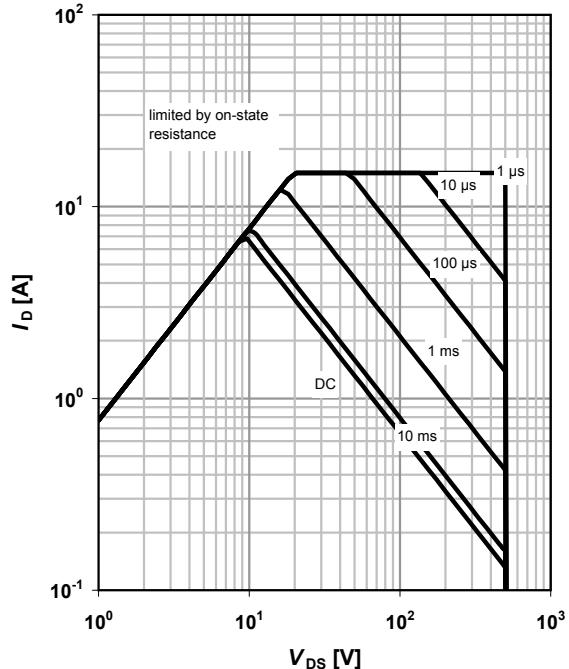
1 Power dissipation

$$P_{\text{tot}} = f(T_c)$$


2 Safe operating area

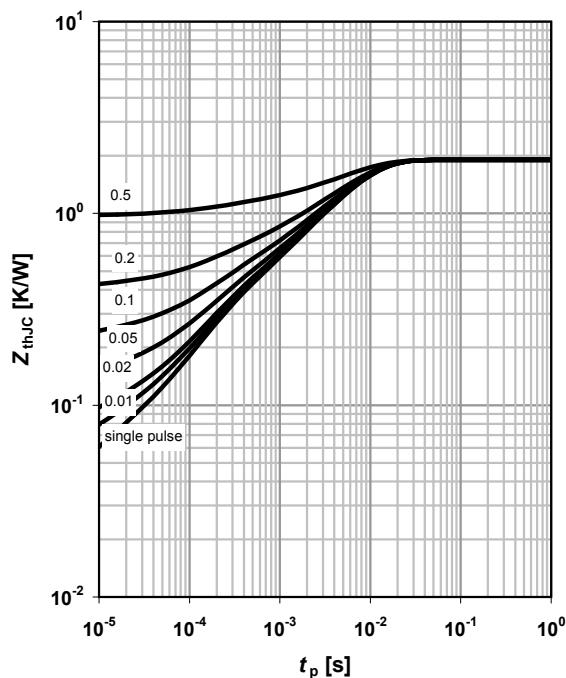
$$I_D = f(V_{DS}); T_c = 25^\circ\text{C}; D = 0$$

parameter: t_p


3 Max. transient thermal impedance

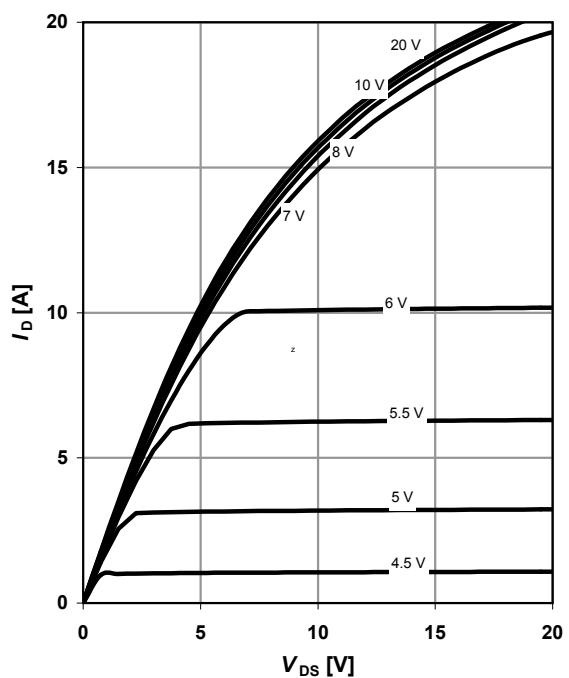
$$Z_{(\text{thJC})} = f(t_p);$$

parameter: $D = t_p/T$


4 Typ. output characteristics

$$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$$

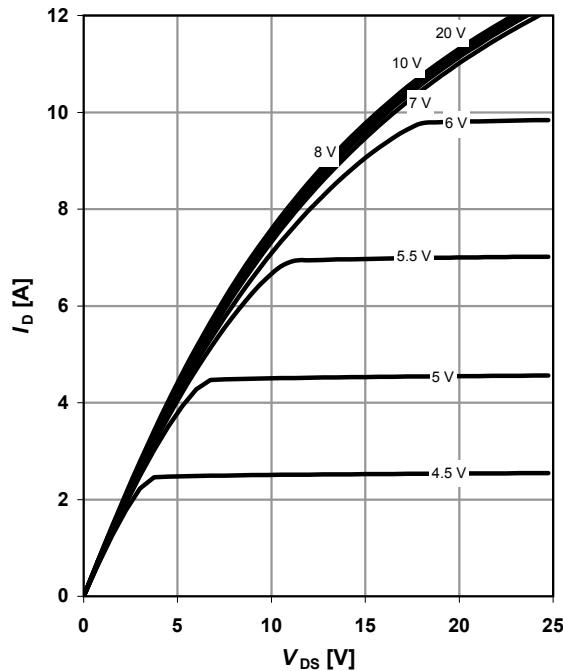
parameter: V_{GS}



5 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=150\text{ }^\circ\text{C}$

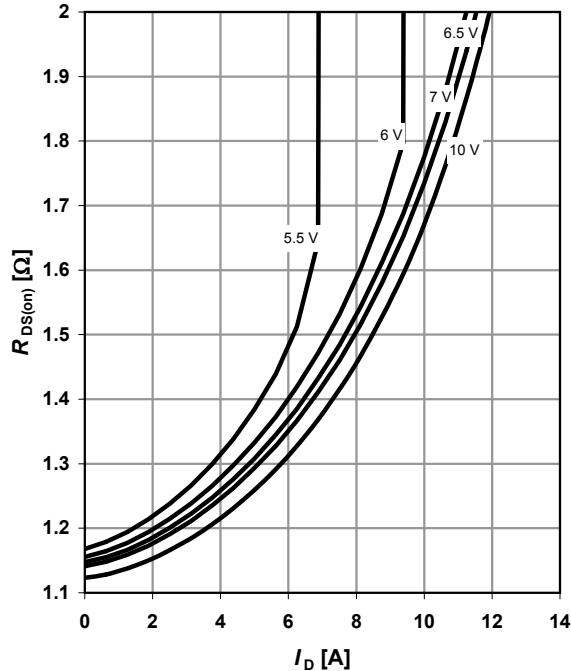
parameter: V_{GS}



6 Typ. drain-source on-state resistance

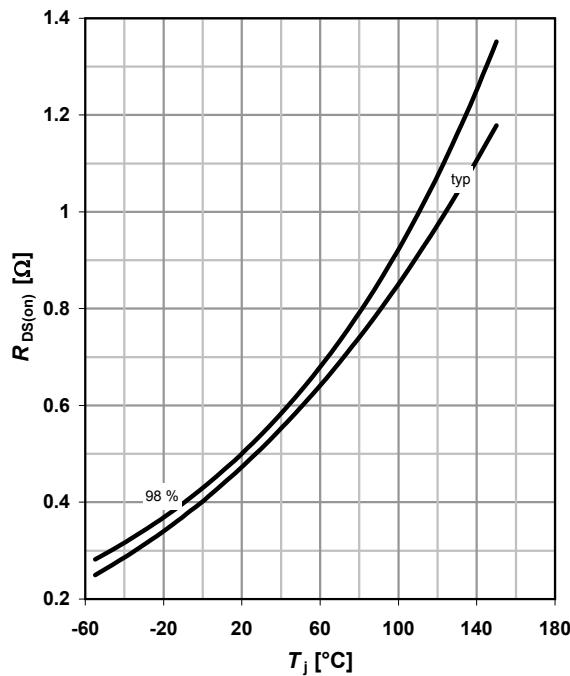
$R_{DS(on)}=f(I_D)$; $T_j=150\text{ }^\circ\text{C}$

parameter: V_{GS}



7 Drain-source on-state resistance

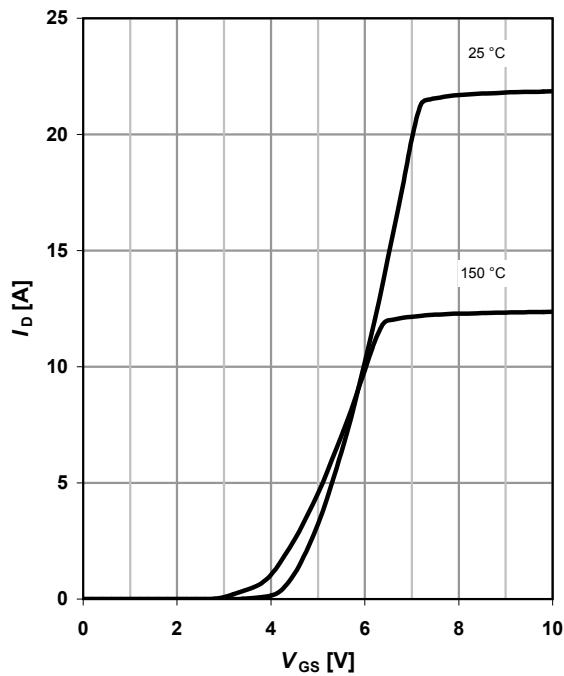
$R_{DS(on)}=f(T_j)$; $I_D=3.8\text{ A}$; $V_{GS}=10\text{ V}$



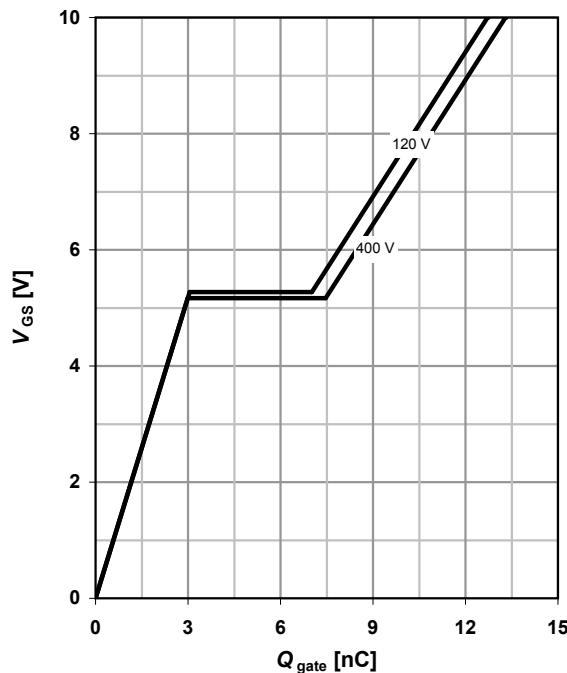
8 Typ. transfer characteristics

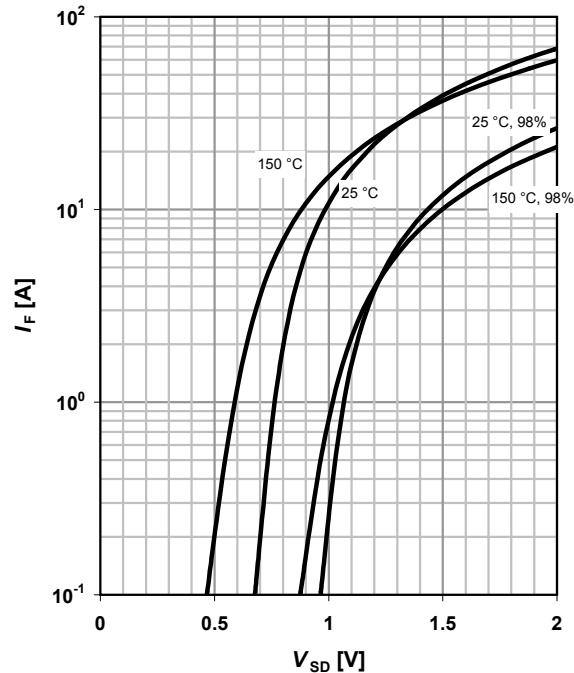
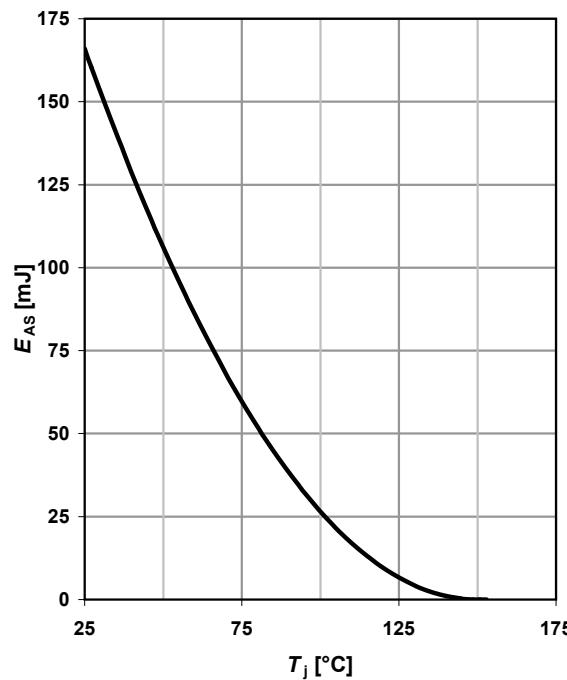
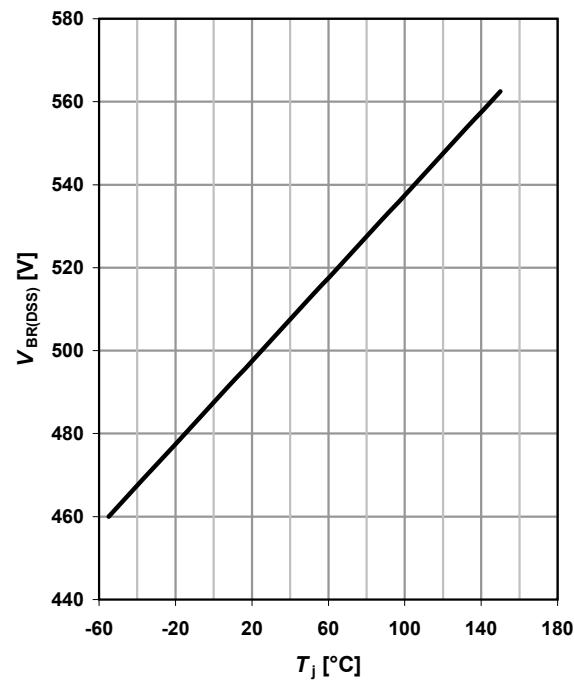
$I_D=f(V_{GS})$; $|V_{DS}|>2|I_D|R_{DS(on)max}$

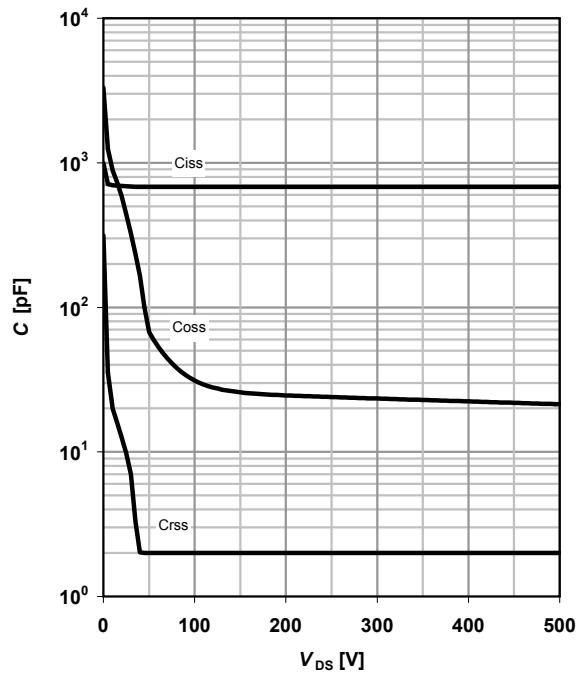
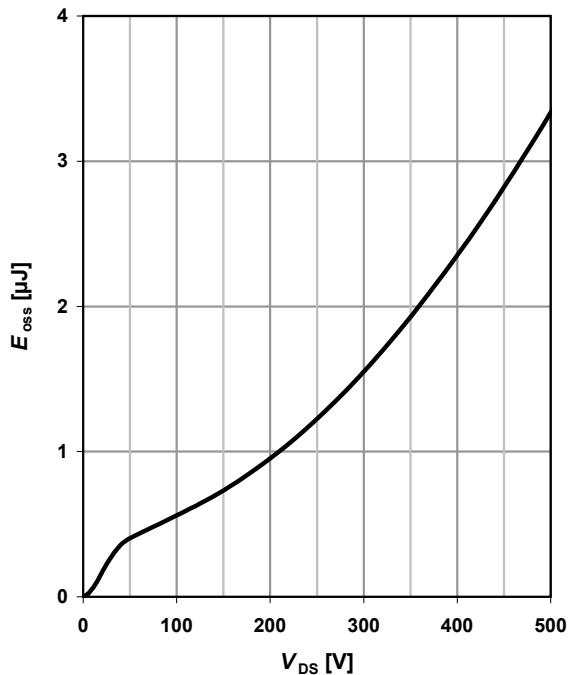
parameter: T_j

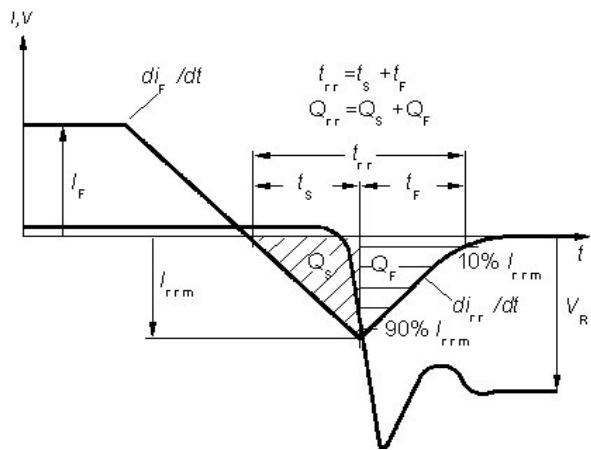


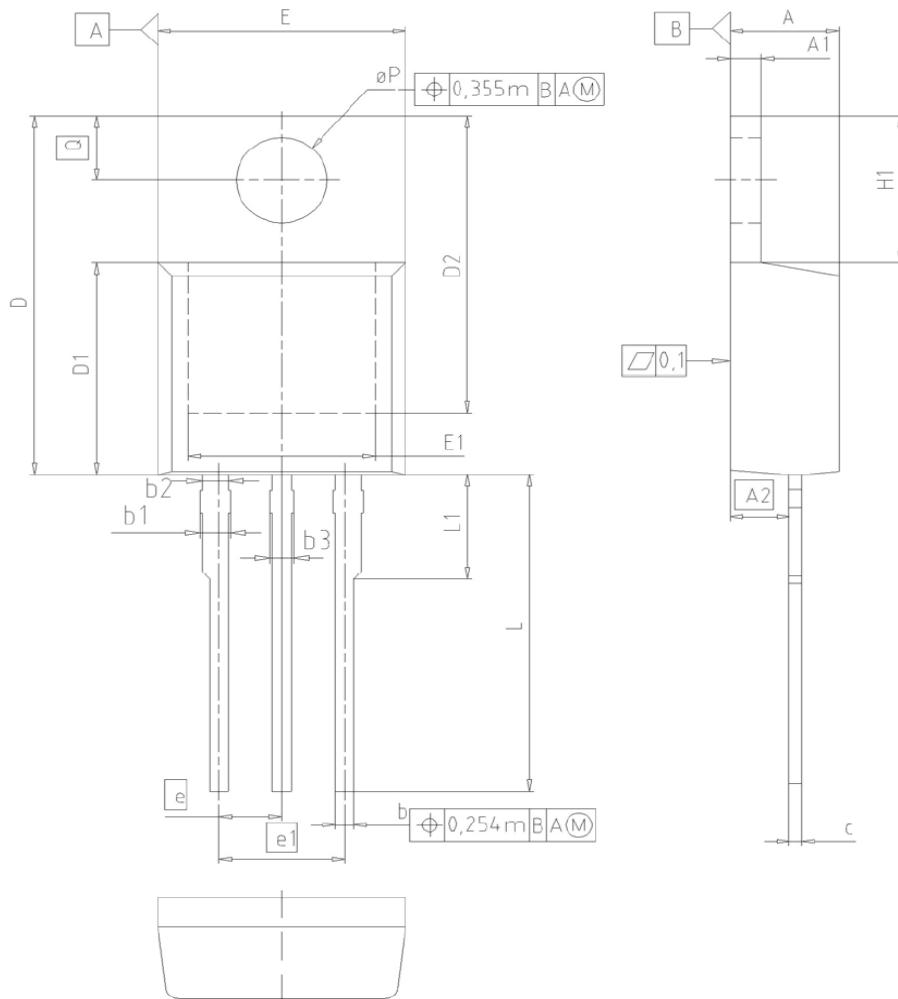
9 Typ. gate charge
 $V_{GS} = f(Q_{gate})$; $I_D = 3.8 \text{ A}$ pulsed

parameter: V_{DD}

10 Forward characteristics of reverse diode
 $I_F = f(V_{SD})$

parameter: T_j

11 Avalanche energy
 $E_{AS} = f(T_j)$; $I_D = 2.5 \text{ A}$; $V_{DD} = 50 \text{ V}$

12 Drain-source breakdown voltage
 $V_{BR(DSS)} = f(T_j)$; $I_D = 0.25 \text{ mA}$


13 Typ. capacitances
 $C=f(V_{DS})$; $V_{GS}=0$ V; $f=1$ MHz

14 Typ. Coss stored energy
 $E_{oss}=f(V_{DS})$


Definition of diode switching characteristics


PG-T0220-3-1/PG-T0220-3-21: Outline


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1.17	1.40	0.046	0.055
A2	2.15	2.72	0.085	0.107
b	0.65	0.86	0.026	0.034
b1	0.95	1.40	0.037	0.055
b2	0.95	1.15	0.037	0.045
b3	0.65	1.15	0.026	0.045
c	0.33	0.60	0.013	0.024
D	14.81	15.95	0.583	0.628
D1	8.51	9.45	0.335	0.372
D2	12.19	13.10	0.480	0.516
E	9.70	10.36	0.382	0.408
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H1	5.90	6.90	0.232	0.272
L	13.00	14.00	0.512	0.551
L1	-	4.80	-	0.189
ØP	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

DOCUMENT NO.	Z8B00003318
SCALE	0 2.5 0 2.5 5mm
EUROPEAN PROJECTION	
ISSUE DATE	23-08-2007
REVISION	05

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Infineon Technologies AG
81726 Munich, Germany
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